

Minn., and West Milan, N. H., 12; Dale Enterprise, Va., and Camp Pilot Butte, Wyo., 13; Stilson, Iowa, 15; Waterville, Wash., and Haywood, Wis., 16; Chama, N. Mex., 17; Adrian, Mo., 18; Atwood and Sandwich, Ill., Point Isabel, Ind., Fairfield, Me., and East Berkshire, Vt., 20.

#### LIMITS OF FREEZING WEATHER.

The southern and western limits of freezing weather are shown on chart II by a line traced from the middle New England coast over the lower lakes, thence to the middle Ohio valley, thence southeastward to north South Carolina and Georgia, thence westward over the south part of the southern plateau, thence northwestward to west-central Oregon, thence eastward over the valley of the Columbia River, thence westward to west-central Washington, and thence northward to British Columbia.

#### RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature are given in the table of Signal Service data. The greatest monthly ranges of temperature occurred in the middle Missouri valley, where they exceeded 60, whence they decreased eastward to less than 30 on the south New England coast, southeastward to less than 25 over extreme south Florida, and to less than 40 on the immediate east Gulf coast, southward to 40 on the west Gulf coast, southwestward to less than 50 over the southern plateau and on the south Pacific coast, and westward to less than 40 on the middle Pacific coast, and to less than 30 at stations on the north Pacific coast.

#### FROST.

The first killing frost of the season was reported as follows: 3d, Carson City, Nev. 5th, Fort Morgan and Magnolia, Colo.; Moab, Utah. 7th, Fort Stanton, N. Mex. 8th, Watkins, Colo. 9th, Roseburgh, Oregon. 10th, Albany and McMinnville, Oregon; Keeler and Susanville, Cal.; Eastport, Me. 11th, Tatoosh Island, Wash.; Walnut Grove, Ariz. 12th, Fort Apache, Whipple Barracks (Prescott), and Holbrook, Ariz.; Glendive, Mont. 13th, Strawberry, Ariz.; Santa Fé, N. Mex. 14th, Cañon City, Hugo, Lamar, Yuma, and Pueblo, Colo.; Dodge City and Wichita, Kans.; Springfield, Mo. 15th, Deer Trail, Colo.; Lunenburg, Vt. 16th, Sheridan Lake, Colo. 17th, Centreville and Ironton, Mo. 18th, Bennet, Colo.; New Frankfort, Mo. 19th, Keokuk and Clarinda, Iowa; Kansas City, Excelsior Springs, and Wither's Mills, Mo.; Howe, Nebr. 20th, Springfield, Louisville, Oswego, and Riley, Ill.; Clinton and McCausland, Iowa; Shelbyville, Ky.; Trenton, Tenn. 21st, Forest Park (Saint Louis), Mo.; Indianapolis and Seymour Ind.; Toledo, Napoleon, Tiffin, and Wauseon Ohio; Detroit, Mich.; Marion and Wytheville, Va.; Morganton and Lenoir, N. C.; Portland, Me. 22d, Boston and Fall River, Mass.; Albany, N. Y.; Cleveland, Sandusky, Garrettsville, Orangeville, and Vienna, Ohio; Lava, N. Mex. 23d, Brady, Tex. 26th, Topeka, Kans. 27th, Hot Springs, Osceola, and Winslow, Ark.; Newnan, Ga.; Marksville La.; Meridian and Hernando, Miss.; Saint Louis, Lebanon, and Willow Springs, Mo.; Leavenworth, Lebo, and Morse, Kans.; Chicago, Ill.; Shiloh, Ohio. 28th, Louisville, Ky.; Vaiden, Miss.; Raleigh, Chapel Hill, Mount Pleasant, and Washington, N. C.; Columbia and Statesburgh, S. C.; Athens, Ga.; Chattanooga, Nashville, Cumberland Gap, Andersonville, Jacksboro, Parksville, Nunnally, Austin, and Hohenwald, Tenn.; Nottoway C. H., Va. 30th, Vevay, Ind.;

Lexington, Ky.; Kenton and Wooster, Ohio; Oak Ridge, N. C.; Dale Enterprise and Summit, Va.; Ogdensburg, N. Y. 31st, Montgomery and Columbiana, Ala.; Atlanta and Athens, Ga.; Agricultural College, University, Batesville, Palo Alto, Pontotoc, and Holly Springs, Miss.; Memphis, Ashwood, Dyersburgh, Covington, Grand Junction, Milan, Florence Station, Franklin, and Clarksville, Tenn.; Canton, Ky.; Cairo, Ill.; Amana, Iowa; Globe, Kans.; Jacksonborough, Ohio; Pittsburgh, Pa.; Washington City; Baltimore and Barren Creek Springs, Md.; Egg Harbor City and Readington, N. J.; Bolar, Lexington, and Staunton, Va.; New York City.

The first black frost of the season was reported at Olympia, Wash., on the 9th; at Tatoosh Island, Wash., on the 13th; at Santa Fé, N. Mex., and near Leavenworth Kans., on the 14th; at Wichita, Kans., on the 16th; at Erie, Pa., Grand Haven, and Port Huron, Mich., on the 22d; at Kansas City, Mo., on the 27th; at Knoxville, Tenn., on the 28th; at Milwaukee, Wis., on the 30th; and at Nashville, Tenn., on the 31st.

Compared with the average date of first killing frost in the respective localities the killing frost of the 14th at Springfield, Mo., and of the 31st at Atlanta, Ga., was about seasonable; that of the 9th at Roseburgh, Oregon, was about 3 weeks early; that of the 14th at Dodge City, Kans., and of the 27th at Hot Springs, Ark., was about one week late; that of the 28th at Columbia, S. C., Chattanooga and Nashville, Tenn., and of the 31st at Cairo, Ill., was about two weeks late; that of the 21st at Indianapolis, Ind., of the 27th at Saint Louis, Mo., and Leavenworth, Kans., and of the 31st at Baltimore, Md., and Washington City was about 3 weeks late; and that of the 28th at Louisville, Ky., and of the 30th at Dale Enterprise, Va., was about 4 weeks late.

Frost occurred as far south as the north part of the Florida Peninsula on the 28th; in extreme west Florida on the 20th, 24th, 27th, and 31st; in extreme south Mississippi on the 27th and 31st; in extreme south Louisiana on the 27th to 29th and 31st; in central Texas on the 5th, 6th, 10th, 23d, 24th, and 31st; to south New Mexico on the 4th, 7th, 13th, and 22d; in south-central and southeast Arizona on the 11th to 15th and 20th; and in the neighborhood of Los Angeles and San Diego, Cal., on the 10th and 11th.

Compared with September, 1890, the limit of frost was about 5° farther south in the Atlantic coast states; 7° to 8° farther south in the Mississippi Valley; and about 5° farther south in the plateau region and on the Pacific coast.

#### TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for October, 1890:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
Boston, Mass.	58.6	47.9	10.7	53.9	51.0
Canby, Fort, Wash.	54.1	51.3	2.8	52.6	52.4
Charleston, S. C.	78.1	67.5	10.6	73.3	67.6
Eastport, Me.	51.6	49.1	2.5	50.4	46.6
Galveston, Tex.	82.0	65.0	17.0	73.9	72.0
Key West, Fla.	87.0	74.5	12.5	83.3	79.6
Portland, Oregon	61.8	52.8	9.0	55.8	52.6

#### PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for October, 1890, as determined from the reports of nearly 2,000 stations, is exhibited on chart III. In the table of Signal Service data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical districts in

the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The heaviest monthly precipitation reported was 14.80, at

Neah Bay, Wash. At Port Moody, B. C., 12.90 fell, and at Juneau, Alaska, the monthly rainfall was 11.31. In extreme west Fla., east-central N. J., extreme west N. Y., on Long Island, in R. I., central Mass., and west-central lower Mich., more than 10.00 was recorded. Over a greater part of southern Cal., and thence northward over the central and western parts of the state to the 40th parallel, no precipitation was reported; and the monthly precipitation was less than 0.50 generally in northern and eastern Cal., southern Oregon, Nev., west Utah, and west Ariz. Over a greater part of the northern and middle plateau regions, the east and west parts of the southern plateau, over a large portion of the eastern slope of the Rocky Mountains, in the middle Missouri valley, in adjoining parts of east-central Mo. and west Ill., and in the Rio Grande Valley above Rio Grande City, Tex., less than 1.00 fell.

The precipitation was generally in excess of the average for October east of the Missouri and Mississippi rivers, except over the north part of the upper lake region and thence eastward to the west coast of the Gulf of Saint Lawrence, in the middle Mississippi valley, on the N. C. coast, and over south Fla. To the west of the Mississippi and Missouri rivers the precipitation was deficient, save on the north Pacific coast, from southeast Wyo. west of south over Ariz., in east-central Tex., south-central Ind. T., and at Rio Grande City, Tex. The greatest excess in precipitation occurred on the southeast New England coast, where it exceeded 6.00; in extreme northwest Wash. and the adjoining part of British Columbia, where it ranged from 4.00 to nearly 6.00; in east-central Tex., where it exceeded 5.00; in extreme west Fla., where it exceeded 4.00; and in northeast Iowa, at Rio Grande City, Tex., and on Prince Edward Island, Gulf of Saint Lawrence, where it exceeded 3.00. The most marked deficiency in precipitation occurred at Key West, Fla., where it was nearly 4.00, and the deficiency was more than 2.00 at Eastport, Me., Quebec, on the N. C. coast, at Springfield, Ill., and Escanaba, Mich.

Considered by districts the average percentage of the normal in districts where the precipitation was in excess was about as follows: east Gulf states, 174 per cent.; New England, 170 per cent.; lower lakes, 164 per cent.; middle Atlantic states, 155 per cent.; southern plateau, 137 per cent.; Ohio Valley and Tennessee, 128 per cent.; extreme northwest, 126 per cent.; Rio Grande Valley, 119 per cent.; west Gulf states, 116 per cent.; upper Mississippi valley, 108 per cent.; north Pacific coast, 103 per cent. In districts where the precipitation was deficient the percentage of the normal was about as follows: at Key West, Fla., 34 per cent.; at Spokane Falls, Wash., 49 per cent.; middle-eastern slope of the Rocky Mountains, 66 per cent.; Missouri Valley, 71 per cent.; and upper lakes and middle plateau, 96 per cent. For the middle Pacific coast, where trace of precipitation was reported for the current month, the normal is 1.06, and on the south Pacific coast, where the average was 0.02, the normal is 0.44. On the south Atlantic coast and on the northeast slope of the Rocky Mountains the precipitation for October, 1890, about equalled the October average.

For the period January to October, 1890, inclusive, the precipitation in the Ohio Valley and Tennessee, the lower lake region, and on the middle Pacific coast, averaged about one-fourth greater, and in New England and the west Gulf states, one-tenth to two-tenths greater than the average, while in the Rio Grande and Missouri valleys, the northeast and middle-eastern slopes of the Rocky Mountains, the middle plateau region, and on the south Pacific coast the precipitation averaged two-thirds to three-fourths of the normal amount for the period named.

The heaviest precipitation ever reported for October occurred at Newburyport and Somerset, Mass., Dyberry and Grampian Hills, Pa., Cumberland, Md., Pensacola, Fla., Grand Coteau, La., Cleveland, Ohio, Port Huron and Thornville, Mich., Fort Buford, N. Dak., Fort Assiniboine, Mont., and Yuma, Ariz., in 1890, when the excess above the normal varied from nearly 6.00 at Somerset, Mass., to nearly 1.00 at Fort Assiniboine,

Mont.; in south New England, eastern N. Y., Pa., and La., in 1877, when the excess varied from 4.00 to 6.00; in the middle and lower Ohio valleys and west Tennessee in 1883, when the excess varied from 3.00 to 6.00; in the upper Mississippi valley in 1881, when the excess varied from 2.00 to 5.00; and in Cal. in 1889, when the excess varied from 2.00 to 7.00.

The least precipitation reported for October occurred at Concordia, Kans., Abilene, Tex., Walla Walla, Wash., and San Francisco, Cal., in 1890, the deficiency varying from 1.15 at San Francisco, Cal., to more than 2.00 at Abilene, Tex.; in Me. in 1874, when the deficiency varied from 2.00 to 3.00; also from west Pa. over east Va., and in the lower Mississippi valley, in 1874; from the south Atlantic coast to the Mississippi River in 1886, when the deficiencies varied from 2.00 to 6.00; from the upper Mississippi valley and the west part of the upper lake region westward over N. Dak. and Mont. in 1889, when the deficiencies varied from 1.00 to 3.00. It will be noted in connection with the distribution of precipitation for October, 1889, that it was the heaviest ever reported for Cal., and the least ever noted over the northern part of the country from Wash. to the upper lakes.

### DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for October for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for October, 1890; (4) the departure of the current month from the average; (5) and the extremes for October during the period of observation and the years of occurrence:

State and station.	County.	(1) Average for the month of Oct.	(2) Length of record.	(3) Total for Oct., 1890.	(4) Departure from average.	(5) Extremes for Oct.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Arkansas.		Inches	Years	Inches	Inches	Inches		Inches	
Lead Hill.....	Boone.....	4.70	9	2.28	-2.42	18.11	1883	0.10	1886
California.									
Sacramento.....	Sacramento.....	0.80	54	0.01	-0.79	7.01	1889	0.00	*
Connecticut.									
Middletown.....	Middlesex.....	3.91	29	7.52	+3.61	14.51	1869	0.89	1868
Florida.									
Merritt's Island.....	Brevard.....	5.74	12	3.85	-1.89	11.94	1886	1.33	1889
Georgia.									
Forsyth.....	Monroe.....	2.82	16	5.89	+3.07	7.86	1879	0.10	1884
Illinois.									
Peoria.....	Peoria.....	2.64	34	3.45	+0.81	5.68	1877	0.70	1860
Riley.....	McHenry.....	2.67	39	5.38	+2.71	6.81	1881	0.29	1867
Indiana.									
Cass.....	Cass.....	2.84	14	2.82	-0.02	5.47	1881	1.00	1889
Vevay.....	Switzerland.....	2.55	25	3.07	+0.52	7.67	1883	0.28	1879
Iowa.									
Grasco.....	Howard.....	2.29	19	3.98	+1.69	8.06	1881	0.13	1889
Monticello.....	Jones.....	2.84	35	6.82	+3.98	7.21	1881	0.43	1872
Logan.....	Harrison.....	2.51	22	1.87	+0.64	6.60	1881	0.46	1889
Kansas.									
Lawrence.....	Douglas.....	2.81	24	5.35	+2.54	6.96	1870	0.44	1878
Wellington.....	Sumner.....	3.46	11	2.63	-0.83	6.32	1882	1.29	1886
Louisiana.									
Grand Coteau.....	St. Landry.....	2.33	7	4.98	+2.65	4.98	1890	T.	1889
Maine.									
Orono.....	Penobscot.....	4.30	20	3.36	-0.94	7.51	1888	1.09	1882
Maryland.									
Cumberland.....	Allegany.....	2.22	19	6.65	+4.43	6.65	1890	0.00	1879
Massachusetts.									
Amherst.....	Hampshire.....	3.92	55	6.98	+3.06	11.36	1869	1.12	1876
Newburyport.....	Essex.....	3.67	12	7.20	+3.53	7.20	1890	0.81	1879
Somerset.....	Bristol.....	3.81	18	9.61	+5.80	9.61	1890	1.17	1879
Michigan.									
Kalamazoo.....	Kalamazoo.....	2.93	14	4.32	+1.39	6.57	1881	1.29	1886
Thornville.....	Lapeer.....	2.90	13	7.96	+5.06	7.96	1890	1.28	1889
Minnesota.									
Minneapolis.....	Hennepin.....	1.93	24	2.46	+0.53	4.92	1868	0.06	1889
Montana.									
Fort Shaw.....	Lewis & Clarke.....	0.51	21	2.20	+1.69	2.22	1883	0.00	1889
New Hampshire.									
Hanover.....	Grafton.....	3.42	49	4.75	+1.33	9.24	1869	0.32	1868
New Jersey.									
Moorestown.....	Burlington.....	3.29	27	5.76	+2.47	6.83	1877	0.47	1879
South Orange.....	Essex.....	3.52	20	6.98	+3.46	7.19	1877	0.27	1879
New York.									
Cooperstown.....	Otsego.....	3.29	36	5.91	+2.62	6.65	1857	0.88	1856
Palermo.....	Oswego.....	3.45	36	4.19	+0.74	7.90	1862	0.30	1882
North Carolina.									
Lenoir.....	Caldwell.....	3.40	19	4.40	+1.00	9.50	1885	0.70	1889
Ohio.									
N. Lewisburgh.....	Champaign.....	2.28	18	3.45	+1.17	5.45	1881	0.45	1887
Wauseon.....	Fulton.....	2.62	18	3.76	+1.14	8.92	1881	0.93	74, '89

## Deviations from average precipitation—Continued.

State and station.	County.	(1) Average for the month of Oct.	(2) Length of record.	(3) Total for Oct., 1890.	(4) Departure from average.	(5) Extremes for Oct.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
<i>Oregon.</i>		<i>Inches.</i>	<i>Years.</i>	<i>Inches.</i>		<i>Inches.</i>		<i>Inches.</i>	
Albany .....	Linn .....	3.64	10	1.74	-1.90	7.15	1882	0.97	1887
Eola .....	Polk .....	3.06	20	2.30	-0.76	8.01	1876	0.30	1874
<i>Pennsylvania.</i>									
Dyberry .....	Wayne .....	3.27	19	7.39	+4.12	7.39	1890	1.23	1882
Grampian Hills .....	Clearfield .....	2.89	20	6.36	+3.47	6.36	1890	0.81	1887
Wellaborough .....	Tioga .....	3.57	11	4.69	+1.12	7.50	1885	0.44	1879
<i>South Carolina.</i>									
Statesburgh .....	Sumter .....	3.05	9	3.35	+0.30	8.15	1887	0.02	1884
<i>Tennessee.</i>									
Austin .....	Wilson .....	2.80	21	4.94	+2.14	5.11	1883	0.38	1886
<i>Texas.</i>									
New Ulm .....	Austin .....	3.83	18	3.11	-0.72	12.44	1881	0.69	1889
<i>Vermont.</i>									
Stratford .....	Orange .....	3.27	17	4.80	+1.53	6.80	1873	1.20	1862
<i>Virginia.</i>									
Birdenest .....	Northampton .....	3.46	21	5.80	+2.34	9.25	1872	T.	1884
<i>Washington.</i>									
Fort Townsend .....	Jefferson .....	2.00	14	2.07	+0.07	3.58	1875	1.00	1885
<i>Wisconsin.</i>									
Madison .....	Dane .....	2.76	21	4.59	+1.83	9.12	1881	T.	1889

\*Frequently.

## EXCESSIVE PRECIPITATION.

Precipitation to equal or exceed 10.00 was reported at 13 stations in Massachusetts, at 2 stations in New York and Rhode Island, and at one station in Florida, New Jersey, Michigan, and Washington; the greatest amount, 14.80, being noted at Neah Bay, Wash.

In October of preceding years monthly precipitation to equal or exceed 10.00 has been reported for 16 years in Fla.; for 11 years in Tex.; for 5 to 8 years in La., N. H., N. Y., N. C., Oregon, and Wash.; and for 1 to 4 years in Ala., Ark., Cal., Conn., D. C., Ga., Ill., Ind., Iowa, Kans., Ky., Me., Md., Mass., Mich., Miss., Mo., Ohio, Pa., R. I., S. C., Tenn., Vt., and Va. In states and territories other than those named precipitation to equal or exceed 10.00 has not been reported for October of preceding years. Among the heavier rainfalls reported for October are: 28.57, at Sims, Cal., in 1889; 20.03, at Mayport, Fla., in 1880; 29.09, at Reidsville, N. C., in 1885; and 14.80, at Ellensburg, Oregon, in 1889. Exclusive of the instances and years cited precipitation to equal or exceed 15.00 in October has been reported for 6 years in Tex.; for 4 years in Fla.; for 2 years in Ga., N. Mex., and Va.; and for 1 year in Ark., La., Me., N. H., and N. C.

Precipitation to equal or exceed 2.50 in 24 hours was reported at 12 stations in La., and on 4 dates, the 15th, 16th, 21st, and 22d; at 10 stations in S. C., and on 5 dates, the 16th, 20th to 23d; at 9 stations in Ga., and on 5 dates, the 13-14th, and 22d to 24th; at 9 stations in Tex., and on 10 dates, the 5th to 7th, 13th, and 16th to 21st; at 7 stations in N. C., and on 2 dates, the 22d and 23d; at 6 stations in Mo., and on 3 dates, the 3d, 12th, and 13th; at 6 stations in Mass., and on 5 dates, the 16th, 17th, and 23d to 25th; at 6 stations in Kans., and on 2 dates, the 12th and 13th; at 5 stations in Mich., and on 3 dates, the 12th, 13th, and 17th; at 5 stations in Iowa, and on 3 dates, the 11th to 13th; at 4 stations in Fla., and on 6 dates, the 1st, 7th to 9th, 21st, and 22d; at 4 stations in Md., and on 5 dates, the 2d, 20th, 21st, 23d, and 24th; at 3 stations in N. J., and on 4 dates, the 2d, 16th, and 23d-24th; at 3 stations in Va., and on 4 dates, the 1st, 2d, and 22-23d; at 2 stations in Ala., and on 2 dates, the 15th and 16th; at 2 stations in N. Y., and on 2 dates, the 3d and 24th; at 2 stations in Pa., and on 2 dates, the 23d and 24th; at 2 stations in R. I., and on 2 dates, the 24th and 25th; at 2 stations in Wis., and on 2 dates, the 9th and 12th; at Washington City, 22-23d; at one station in Miss., on the 16th; at one station in N. Dak., on the 13-14th; at one station in Ohio, on the 12-13th; at one station in Wash., on the 20th; and at one station in W. Va., on the 22-23d. Among the heavier rainfalls reported for this period are: 5.15 at Jacksonville, Fla., 1st;

5.15 at New Bedford (1), Mass., 23d-24th; 5.08 at Abbeville, La., 21st; 5.02 at Trial, S. C., 22-23d; 4.91 at Rio Grande City, Tex., 18-19th; 4.43 at Washington, N. C., 22-23d; 4.40 at Berlin, Mich., 13th; 4.05 at White Plains, N. Y., 3d; and 4.02 at Freehold, N. J., 23d-24th.

In October of preceding years precipitation to equal or exceed 2.50 in 24 hours has been reported for 15 years in Fla.; for 13 years in Tex. and N. C.; for 12 years in Ga. and Pa.; for 11 years in La.; for 5 to 10 years in Ala., Conn., Ill., Ind. T., Kans., Me., Md., Mass., Miss., Mo., Nebr., N. H., N. J., Ohio, N. Y., R. I., S. C., and Va.; and for 1 to 4 years in Ark., Cal., the Dakotas, D. C., Ind., Iowa, Ky., Mich., Minn., Oregon, Tenn., Utah, Vt., Wash., Wis., Del., and N. Mex. In states and territories other than those named precipitation to equal or exceed 2.50 in 24 hours has not been reported for October of preceding years. Among the heavier 24-hour rainfalls reported for October of preceding years are: 10.31, at Saint Augustine, Fla., 9-10th, 1888; 13.14, at Fernandina, Fla., 20th-21st, 1882; 9.24, at Key West, Fla., 20th-21st, 1883; 8.20, at Newport, Fla., 8th, 1876; 7.07, at Fort Robinson, Nebr., 23d, 1887; 7.77, at Galveston, Tex., 2d, 1871; and 13.08, at Brackettville, Tex., 1st-2d, 1881. Exclusive of the instances and years cited precipitation to equal or exceed 5.00 in 24 hours in October has been reported for 3 years in Fla. and Tex.; for 2 years in Ga., La., and N. C.; and for 1 year in Md., Miss., N. Y., Pa., S. C., Tenn., Va., and Wash.

Precipitation to equal or exceed 1.00 in one hour was reported at 2 stations in La., and on 2 dates, the 11th and 15th; at 2 stations in Tex., and on 2 dates, the 10th and 19th; at 2 stations in Pa., and on 2 dates, the 2d and 13th; at one station in Conn., on the 19th; at 1 station in Fla., on the 1st; at one station in Ga., on the 22d; at 1 station in Iowa, on the 12th; at 1 station in N. J., on the 2d; and at 1 station in Wis., on the 9th and 12th. Remarkably heavy rainfalls in one hour were not reported for October, 1890, and excessive rainfall for 5 and 10 minute periods are given in the table of "Maximum rainfalls in one hour, or less."

In October of preceding years precipitation to equal or exceed 1.00 in 1 hour has been reported for 8 years in Tex.; for 4 years in Iowa, Kans., Mo., and N. C.; for 3 years in D. C., Fla., Ill., and Nebr.; for 2 years in Ala., Ind., and La.; and for 1 year in Ark., Ga., Ind. T., Md., Miss., N. Y., Ohio, and S. C. In states and territories other than those named precipitation to equal or exceed 1.00 in 1 hour has not been reported for October of preceding years. Among the heavier rainfalls reported for 1 hour or less in October of preceding years are: 1.20 in 6 minutes, at Brownsville, Tex., 23d, 1884; 1.80 in 20 minutes, at Fort Scott, Kans., 2d, 1881; 1.11 in 20 minutes, at Cresco, Iowa, 10th, 1878; 2.12 in 25 minutes, at Galveston, Tex., 30th, 1877; and 2.30 in 30 minutes, at Des Moines, Iowa, 15th, 1880.

Table of excessive precipitation, October, 1890.

State and station.	Month of rainfall to inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch or more, in one hour.		
		Am't.	Day.	Am't.	Time.	Day.
<i>Alabama.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
Mobile .....	3.04	15-16				
Mount Vernon Barracks .....	2.80	16				
<i>Alaska.</i>						
Juneau .....	11.31					
<i>Connecticut.</i>						
New Haven .....				1.18	1 00	19
<i>District of Columbia.</i>						
Washington City .....		3.39	22-23			
<i>Florida.</i>						
Fort Barrancas .....	10.46	3.89	7-8			
Do. ....		3.55	21-22			
Jacksonville .....	5.15	5.15	1			
Jupiter .....				1.10	1 00	1
<i>Pennsylvania.</i>						
Tallahassee .....	3.59	8-9				
<i>Georgia.</i>						
Athens (1) .....	3.12	22-23				
Augusta .....	2.75	22				

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall in inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Georgia—Continued.						
Bainbridge	Inches.	3.80	22			
Diamond		2.80	13-14			
Gainesville		3.00	22			
Milledgeville		3.55	22			
Point Peter		3.50	22			
Savannah		3.79	23-24	1.00	0 32	22
Thomasville (1)		3.90	22			
Thomasville (2)		3.56	22			
Iowa.						
Eagle Grove		3.10	11			
Monticello		2.61	12			
Osage		2.57	12-13	1.58	1 10	12
Webster City		2.50	11			
West Bend		2.50	11-12			
Kansas.						
Elco		3.05	12-13			
Emporia		2.83	12			
Globe		3.15	12-13			
Leavenworth		2.50	12-13			
Lebo		4.16	12			
Morae		4.02	12-13			
Louisiana.						
Abbeville		5.08	21			
Baton Rouge		2.68	21			
Grand Coteau		2.59	21-22			
Houma		3.18	21			
Jackson Barracks				1.42	1 00	11
Lafayette		4.34	21			
Luling		2.50	21			
New Iberia		2.60	21			
New Orleans		2.63	15-16	1.50	1 00	15
Paincourtville		2.70	21-22			
Port Eads		2.66	21-22			
Shell Beach		2.54	15			
Thibodeaux		3.61	21			
Maryland.						
Baltimore		3.04	23			
Barren Creek Springs		3.65	2			
Frederick		2.59	23-24			
Mount Saint Mary's College		2.95	20-21			
Massachusetts.						
Blue Hill (summit)		2.96	24			
Brewster		3.57	24-25			
Conit	10.14					
Fall River (1)	10.47					
Framingham	10.26					
Lake Cochituate	10.11					
Long Plain	10.66					
Middleborough	10.55					
Milton		3.20	24-25			
New Bedford (1)	10.01	5.15	23-24			
New Bedford (3)		4.77	24			
Princeton	10.04					
Royalston	11.62	3.00	16-17			
Somerset		4.45	23-24			
South Hingham	10.81					
Taunton (3)	10.44					
Waltham	10.48					
Westborough	10.85					
Wood's Holl		4.50	24-25			
Michigan.						
Benton Harbor		2.85	13			
Berlin	11.02	4.40	13			
Cassopolis		2.85	12			
Charlevoix		4.00	17			
Vandalia		2.79	13			
Mississippi.						
Moss Point		2.51	16			
Missouri.						
Brunswick		2.50	3			
Carrollton		3.38	12-13			
Excelsior Springs		3.20	12-13			
Kansas City		3.40	12-13			
Do		3.05	13			
Liberty		2.88	12			
New Jersey.						
Freehold		4.02	23-24			
Imlaystown		2.74	2	2.74	2 00	2
Oceanic	10.18	2.53	16			
New York.						
Setauket	10.20	3.16	24			
Sherman	10.19					
White Plains		4.05	3			
North Carolina.						
Chapel Hill		2.85	22			
Charlotte		2.84	22-23			
Hatteras		2.97	22-23			
Hendersonville		3.50	22-23			
Mount Holly		3.02	22-23			
Mount Pleasant		2.59	22			
Washington		4.43	22-23			
North Dakota.						
Fort Pembina		2.88	13-14			
Ohio.						
Wooster		3.82	12-13			
Pennsylvania.						
Harrisburg				1.00	1 00	2
Maibet		2.80	23-24			
Pittsburgh				1.00	1 00	13
Wellsborough		2.68	23			

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall in inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
<i>Rhode Island.</i>						
Kingston (1)	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
Kingston (2)	10.04	2.99	24			
Lonsdale	10.55					
Narragansett Pier		3.50	24-25			
<i>South Carolina.</i>						
Belmont		3.33	22			
Charleston		4.05	22-23			
Evergreen		3.25	23			
Hardeeville		2.52	22-23			
McCormick		2.98	20-21			
Port Royal		3.40	22-23			
Simpsonville		2.60	22-23			
Spartanburgh (1)		2.51	16			
Trial		5.02	22-23			
Yorkville		2.47	16			
<i>Texas.</i>						
Brazoria		2.85	20-21			
Brownsville		2.71	16-17			
Columbia		2.50	13			
Dallas (2)		2.62	21			
Edinburgh		3.90	19	2.35	1 10	19
Grapevine		4.00	20-21			
Hearne		4.80	6-7			
La Grange				1.13	0 25	10
Palestine		4.59	5-6			
Do		2.67	20-21			
Rio Grande City		4.91	18-19			
<i>Virginia.</i>						
Mossing Ford		3.00	22-23			
Petersburgh		3.22	1-2			
Richmond		2.80	1			
<i>Washington.</i>						
Neah Bay	14.80	3.30	20			
<i>West Virginia.</i>						
Harper's Ferry		3.10	22-23			
<i>Wisconsin.</i>						
Potosi		2.68	12			
Wauzeka		4.00?	9	4.00?	3 00	9
Do		4.00?	12	4.00?	4 00	12

Received too late to be used in general discussion for October, 1890.

<i>Iowa.</i>						
Sac City		2.50	10-11			
<i>Missouri.</i>						
Bradleyville				1.10	0-16	5
Kidder		2.70	12-13			
<i>North Carolina.</i>						
Clear Creek		2.75	22-23			
<i>Pennsylvania.</i>						
Carlisle		3.08	23			
<i>Texas.</i>						
Fredericksburgh		3.40	5-6			
<i>Washington.</i>						
Lapush		4.03	20-21			

Corrections: Potosi, Wis., June, 1890, day of month should be 3 instead of 2; July, 1890, page 181, strike out Potosi, Wis.

## SNOW (snowfall in inches and tenths).

The first snow of the season was reported as follows: 2d, Joseph, Oregon. 3d, Henry's Lake, Idaho; Richfield, Utah. 4th, Denver, Colorado Springs, Montrose, and Smoky Hill Mine, Colo.; Cheyenne, Wyo. 5th, Mounts Thomas and Ord (about 15 miles from Fort Apache, Ariz.). 7th, Farmington, Me.; Strafford, Vt.; Kimball, Nebr. 8th, Berlin Mills, N. H.; Northfield, Vt.; Glasgow, Wis.; Hay Springs, Nebr.; Taylor's Ranch, Utah; Spokane Falls, Wash.; Lakeview and Heppner, Oregon; Walla Walla Creek, Cal. 9th, Carson City, Nev.; Beulah, Oregon. 10th, Bismarck, N. Dak. 11th, Salt Lake City and Parowan, Utah. 13th, Logansport, Ind.; Oshkosh, Wis. 14th, Fort Du Chesne and Mount Pleasant, Utah. 15th, Pueblo, Colo.; Gallatin, N. Dak. 19th, Wytheville, Va. 20th, Frederick, Md. 23d, Woodstock, Md.; Number Four, N. Y. 24th, Concord, Mass. 25th, Point Isabel, Ind.; Greenfield, Iowa; Hartland, Vt. 26th, Parkersburgh, W. Va.; Belmont, Mansfield, and Wauseon, Ohio; Hendersonville and Lenoir, N. C.; Lithia Springs and Marietta, Ga.; Alpena and Manton, Mich. 27th, Binghamton and Palermo, N. Y.; Asheville, N. C.; Blue Knob, Le Roy, Wellsborough, and Pleasant Mount, Pa.; Blue Ridge Mountains (35 miles north of Lynchburgh, Va.); Greenville, Tenn. 28th, Koepenick, Wis.; Hudson, Ypsilanti, and Port Huron, Mich.; Duluth, Minn.; New Lisbon, N. Y.; Garrettsville, Tiffin, and Westerville, Ohio;

Dyberry, Clarion, Grampian Hills, and Philipsburgh, Pa.; East Berkshire and Lunenburg, Vt. 29th, Aurora, Collinsville, Chicago, Ottawa, and Riley, Ill.; Indianapolis and Mauzy, Ind.; Amana, Larabee, and Storm Lake, Iowa; Lexington, Frankfort, Harrodsburgh, and Shelbyville, Ky.; Albion, Mottville, Thornville, Lansing, Manistee, Grand Haven, and Detroit, Mich.; Red Wing, Minneapolis, and Saint Paul, Minn.; Canton and Madison Barracks, N. Y.; Highlands, N. C.; Demos, Gratiot, North Lewisburgh, Vienna, Columbus, and Zanesville, Ohio; Flandreau, S. Dak.; Glennville, Ella, and Rowlesburgh, W. Va.; North Sutton, N. H.; Green Bay, Embarrass, and Milwaukee, Wis.; Springdale and Andersonville, Tenn. 30th, Louisville and Olney, Ill.; Vevay and Cannelton, Ind.; Independence, Iowa.; Horton, Kans.; Newport Barracks, Ky.; Saint Charles, Mo.; Fremont, Crete, Tecumseh, and Weeping Water, Nebr.; East Canterbury and Antrim N. H.; Buffalo, N. Y.; Cincinnati, Cleveland, Orangeville, and Napoleon, Ohio; Pittsburgh, Altoona, and Corry, Pa.; Canton, S. Dak.; Knoxville, Jacksboro, and Rogersville, Tenn.; Oceana, Point Pleasant, Morgantown, Wheeling, and Charleston, W. Va. 31st, Baltimore, Md.; Kalamazoo, Mich.; State College, Pa.; Dale Enterprise, Va.; Louisa and Falmouth, Ky.; Vincennes, Ind.; Mount Carmel, Ill.

The greatest depth of snowfall for the month was reported at elevated stations in west-central and extreme south-central Colo., where it varied from 20.0 to 29.0. In extreme southwest Mont. over 26.0 fell; in west and northwest Mont., from 2.0 to 8.0; along the line of the Central Pacific Railroad crossing the Sierra Nevada Mountains in Cal., 2.0 to 7.0; in the northeast part of lower Idaho, 6.0 to 8.0; in central and west Nev., 2.0 to 5.0; in south-central and southeast Wyo., 3.0 to 7.0; in southwest Nebr., 5.0; in extreme northwest Minn., 8.0; in north-central upper Mich., more than 10.0; in central and southwest lower Mich., 3.0; in northeast Wis., 5.0; in extreme west N. Y., 11.0; in central N. Y., 1.0 to 3.0; in south-central west Pa., 8.0 to 11.0; in northeast W. Va., 8.0. East of the Mississippi River snow fell as far south as east Tenn.; in the Mississippi and Missouri valleys to the 40th parallel; in the Rocky Mountain and plateau regions to extreme south Colo. and Utah; and in east Cal. to about the 38th parallel.

In October, 1889, snow fell north of a line traced from extreme south N. J. westward to southeast Ohio, thence northwest to central Mich., thence southwest to north Ill., thence northward to extreme northwest Mich., thence to north N. Dak., thence southward to extreme south Kans., thence southwest to central N. Mex., thence northward to south Wyo., thence to south-central Utah, thence to east Cal. in about latitude north 38°, and east of this line continued northward over east Oregon.

Snowfall of one inch, or more, was reported as follows: *California*.—Boca, 7; Truckee, 4; Cisco, 3.5; Emigrant Gap, 2. *Colorado*.—Breckenridge, 29; Dillon, 20.8; Cumbres, 20; Climax, 18.3; Leadville, 18; Georgetown, 11; Como (near), 10.5; Pinkhamton, 10; Moraine, 7.5; Alma, 7; Stamford, 6.5; Saint Cloud, 6; Elkhorn, 5; Fort Collins, 3.2; Fort Collins (near), 3; Greenhorn, 2.5; Bennet, Husted, Magnolia, Pueblo, and Thon, 2; Delta, 1.8; Colorado Springs, 1.6; Aroya, 1.2; Eagle Farm, 1. *Idaho*.—Henry's Lake, 7.8; Era, 6.2; Beaver, 6. *Indiana*.—Point Isabel, 1.2; Columbia City, 1. *Michigan*.—Marquette, 10.9; Crystal Falls, 6.7; Vienna, 3.4; Berlin, Caldwell, Manistee, and Paw Paw, 3; Mottville, 2.5; Bellaire, 2.1; Alpena, 1.8; Birch Run, 1.6; Parkville, 1.5; Gaylord and Weldon Creek, 1.3; Gulliver Lake and Harbor Springs, 1.1; Atlantic, Berrien Springs, Calumet, Harrison, Lathrop, and Washington, 1. *Minnesota*.—Saint Vincent, 8. *Montana*.—Virginia City, 26.5; Choteau, 8; Fort Logan, 5; Helena, 2; Fort Custer, 1.3. *Nebraska*.—Kimball, 5. *Nevada*.—Austin, 5.5; Downeyville, 4.5; Hawthorne, 4; Columbus, 3; Candelaria, 2.5; Virginia City, 2.3; Pioche, 1.8; Palisade, 1. *New Hampshire*.—Berlin Mills, 3; North Sutton, 1. *New York*.—Cherry Creek, 11; Humphrey and Sherman, 6; Keene Valley, 3; Adams Centre,

Brookfield, and South Canisteo, 2; Constableville, Newark Valley, and Turin, 1. *Ohio*.—Garrettsville, Hudson, and Weymouth, 3; Vienna, 2.2; Celina, Greenville, and Orangeville, 2; Ashland, 1.9; Gratiot and Wooster, 1. *Oregon*.—Joseph, 1.8; Hardman, 1. *Pennsylvania*.—Blue Knob, 11.5; Somerset, 8.2; Eagle's Mere, 4.2; Grampian Hills, 3.5; Corry, 3; Meadville (2), 2.2; Rimersburgh, 1.8; Erie and Greenville, 1. *Tennessee*.—Springdale, 2; Greeneville, 1.1. *Utah*.—Parowan, 2.5. *Vermont*.—Strafford, 1. *Virginia*.—Bolar, 2. *West Virginia*.—Pleasant Hill, 8; Tannery, 1. *Wisconsin*.—Butternut and Koepenick, 5. *Wyoming*.—Saratoga, 7; Camp Sheridan, 6.5; Fort McKinney, 6.4; Laramie, 3.8; Camp Pilot Butte, 1.6.

#### DEPTH OF SNOW ON GROUND AT CLOSE OF MONTH.

On the last day of the month a depth of 7.0 was reported at Marquette, Mich.; trace to 0.3 in northeast Minn.; trace to 0.5 in east Wis.; over 1.00 in extreme north lower Mich.; trace in extreme northeast Ohio; 0.5 to 2.0 in extreme west N. Y.; 0.5 in north-central N. Y.; and 1.0 to 5.0 in the mountains of Pa.

#### MAXIMUM RAINFALL IN ONE HOUR OR LESS.

The following table is a record of the heaviest rainfall during October, 1890, for periods of five and ten minutes and one hour, as reported by regular stations of the Signal Service furnished with self-registering gauges:

Station.	Maximum fall in—					
	5 min.	Date.	10 min.	Date.	1 hour.	Date.
	Inch.		Inch.		Inch.	
Bismarck, N. Dak.	0.17	4	0.22	4	0.09	12
Boston, Mass.	0.05	14	0.10	14	0.45	4
Buffalo, N. Y.	0.10	4	0.15	4	0.25	14
Cincinnati, Ohio	0.06	6	0.11	6	0.30	4
Chicago, Ill.	0.30	13	0.40	13	0.50	6
Cleveland, Ohio	0.30	13	0.40	13	0.55	13
Denver, Colo.	0.20	13	0.27	13	0.10	9
Detroit, Mich.	0.25	12	0.30	12	0.39	13
Dodge City, Kans.	0.08	12	0.17	13	0.52	12
Duluth, Minn.	0.30	13	0.45	13	0.35	13
Eastport, Me.	0.30	20	0.45	20	0.10	20
Galveston, Tex.	0.30	1	0.50	1	0.95	20
Jupiter, Fla.	0.30	1	0.50	1	1.00	1
Key West, Fla.	0.30	10	0.45	10	0.55	10
Marquette, Mich.	0.05	22	0.08	6	0.25	22
Memphis, Tenn.	0.05	17	0.12	17	0.42	22
New York City	0.30	15	0.45	15	1.50	16
New Orleans, La.	0.16	23	0.19	23	0.30	23
Norfolk, Va.	0.03	6	0.05	6	0.23	6
Philadelphia, Pa.	0.05	16	0.12	16	0.75	16
Philadelphia Water Works	0.05	16	0.05	16	0.15	16
Portland, Oregon	0.15	12	0.20	12	0.43	12
Saint Paul, Minn.	0.15	12	0.20	12	0.43	12
San Diego, Cal.	0.08	10	0.09	10	0.23	10
San Francisco, Cal.	0.35	22	0.60	22	1.00	22
Santa Fe, N. Mex.	0.05	23	0.08	23	0.40	23
Savannah, Ga.	0.05	23	0.08	23	0.40	23
Washington City	0.20	16	0.35	16	0.45	16
Wilmington, N. C.	0.20	16	0.35	16	0.45	16

\*Not sufficient to register. †No record on account of snow. ‡Less than .05 in 1 hour.

#### HAIL.

Description of the more severe hail storms of the month is given under "Local storms." Hail was reported as follows: 1st, Ariz., Colo., Wash. 3d, Kans., Utah. 4th, Ind. 6th, Ariz., Iowa. 8th, Colo. 9th, Iowa. 10th, Ariz., Iowa, Kans., Nev. 11th, S. Dak., Utah. 12th, Ill., Iowa., Kans. 13th, Ill. 14th, Mich., N. Y., Ohio, Oregon, Pa. 16th, Oregon, S. C. 17th, Mich., N. Y. 18th, Mich., Ohio, Oregon. 19th, Conn., Mich., N. J., N. Y., Pa. 21st, Ind. T. 23d, Pa. 25th, Ill., Ind., Tenn. 26th, Ga., Ky., Mich., N. C., Ohio, Pa., Va. 27th, Ky., N. C. 28th, Ind., Mich., Ohio, Wis. 29th, Ill., Ky., Mass., Mich., N. J., N. Y., N. C., Ohio, Pa., Wis. 30th, Ind., Mich., N. J., N. Y., Ohio, Pa., Tenn. 31st, N. Y.

#### SLEET.

Sleet was reported as follows: 2d, Utah. 11th, Ariz., Nev. 13th, Minn. 14th, Minn., Wis. 15th, Pa. 16th, Minn. 18th, Wis. 23d, Conn., Md., N. Y. 24th, Mass. 25th, Ind., Minn. 26th, Ga., Ind., Mich., Pa., Tenn., W. Va. 27th, N. Y., Ohio. 28th, Mich., Minn., N. Y., Vt. 29th, Ill., Iowa, Mich., N. Y., Ohio, Pa. 30th, Mich., Ohio, Tenn. 31st, Ill., N. Y., Ohio, Wis.



## WINDS.

The prevailing winds during October, 1890, are shown on chart II by arrows flying with the wind. In New England and the north part of Florida the winds were generally from north-west to northeast; in the middle Atlantic states and on the south Pacific coast from west to northwest; in the south Atlantic states, the Ohio Valley and Tennessee, the lower lake region, in the upper Mississippi valley, on the northeast slope of the Rocky Mountains, and over the middle plateau region from southwest to northwest; over south Florida from south to east; in the east Gulf states, the upper lake region, and on the middle Pacific coast from west to north; in the west Gulf states and the lower Rio Grande valley from northeast to southeast; in the extreme northwest from the northwest; in the Missouri Valley from southeast to south; on the southeast slope of the Rocky Mountains from south to southwest; over the northern plateau region from southeast to southwest; on the north Pacific coast from south to west; and on the middle-eastern slope of the Rocky Mountains and over the southern plateau region, variable.

## HIGH WINDS (in miles per hour).

Wind velocities of 50 miles, or more, per hour were reported at regular stations of the Signal Service, as follows: 1st, 67, sw., at Fort Canby, Wash. 4th, 52, w., at Bismarck, N. Dak.; 60, w., at Fort Buford, N. Dak. 6th, 60, w., at Fort Cauby, Wash. 13th, 50, sw., at Chicago, Ill. 17th, 60, nw., at Wood's Holl., Mass.; 54, se., at Block Island, R. I.; 52, nw., at Atlantic City, N. J. 18th, 52, n., at Grand Haven, Mich.; 72, se., at Fort Canby, Wash. 19th, 54, ne., at Boston, Mass. 24th, 54, ne., at Nantucket, Mass.; 78, ne., at Block Island, R. I. 25th, 72, e., at Block Island, R. I. 27th, 54, ne., at Nantucket, Mass.

## LOCAL STORMS.

4th.—Heavy showers of rain, with thunder and lightning, occurred at Yuma, Ariz., in the early morning. Bridges were carried away, washouts occurred on the railroad, and telegraph lines were prostrated. The greatest damage was reported about 20 miles east of Yuma. At Fort Buford, N. Dak., a heavy gale from the west began at midnight and continued until 9.35 p. m., the wind attaining a maximum velocity of 60 miles per hour. Fences and outhouses were blown down. 5-6th.—Heavy north and northeast gales and snow storms prevailed over the Gulf of Saint Lawrence. 11th.—A heavy thunder-storm passed over Stilson, Iowa, at 9 p. m. A barn was struck by lightning and 3 horses killed. 12th.—During a thunder-storm high wind injured houses, uprooted trees, etc., at Heaton, Ind. T. At Berlin, Tex., 2 head of cattle were struck by lightning and killed during a thunder-storm. A severe wind storm, with lightning, occurred at Corsicana, Tex., in the evening. Several houses were blown down and trees were uprooted. A heavy hail storm was reported in the southern part of Webster Co., Iowa, the morning of the 12th. A severe rain storm, with thunder and lightning, was reported at Bellaire, Ohio, in the early morning. Streams rose rapidly, overflowing lowlands and causing washouts on railroads. Heavy rain swelled streams in north West Virginia, causing great damage to railroads, bridges, etc. 12-13th.—Heavy rain, with thunder and lightning, began at Lebo, Kans., at 2.15 p. m., 12th, and ended 6.10 a. m., 13th, during which time 5.00 inches fell. Lebo Creek overflowed its banks, causing damage to wheat fields. A heavy gale prevailed over Lake Superior. 13th.—A heavy gale prevailed over the upper lakes. The barge "Warren" was wrecked at Alpena, Mich. Hard gales also prevailed on Lake Erie. A violent wind and rain storm began at Conway, Ark., at 4 a. m. and continued about 30 minutes, damaging trees and fences. A severe storm visited Andale, Kans., in the afternoon, doing damage to small buildings, etc. A severe rain storm caused damage to crops and railroad property along the Monongahela and Little Kanawha rivers and tributaries in West Virginia. 13-14th.—

High winds, heavy seas, and disasters were reported on the upper lakes. 14th.—Numerous disasters to shipping reported on the upper lakes. At Port Arthur, Ont., the machinery and material for the new breakwater were washed away. 15th.—In the afternoon heavy rain flooded streets and suspended street traffic at New Orleans, La.

16th.—A moderate thunder-storm moved southeast over Wilmington, N. C. Several local storms were reported within a radius of 100 miles of Wilmington, N. C. One appears to have originated about noon about 10 miles southwest of Cheraw, S. C., and moved from sw. to ne., cutting a path for a few miles through the forest. Another was reported, about 2 p. m., a few miles south of Hamlet, N. C., and moved from sw. to ne. a distance of about 2 miles, with but slight damage. Another, the most destructive, seems to have started a few miles south of Hasty, N. C., and moved from sw. to ne., passing south of Hasty and nw. of Maxton, N. C., and ending a few miles ne. of Floral College, N. C., the track being about 20 miles in length, and following the general direction of the Cape Fear and Yadkin Valley Railroad, with a slight deflection to the northwestward where it crossed the Lumber River. This storm was attended by heavy rain and electrical discharges which preceded the passage of a funnel-shaped cloud. The funnel seemed to whirl from south to east, or from left to right, and during its passage trees were torn up, houses demolished, one person killed, and several seriously injured. The damage to houses, all of which were small, was estimated at \$1,000, and to crops \$1,000. The storm was attended by a roaring sound, and the width of the path at the place of greatest destruction, near Hasty, was 60 feet, but trees were torn down a distance of 100 yards on either side and fell towards the track. This storm appeared to be a well-defined tornado, and the small loss of life and property was due to the very thinly settled country through which it passed.

17th.—A violent storm caused much damage to shipping along the New England, New York, and New Jersey coasts. At New York City high northerly winds and high tides prevailed. A tug boat was sunk by collision due to wind and tide off the Battery and two lives lost. At Block Island, R. I., the storm commenced 1.40 a. m., and the wind attained a velocity of 54 miles per hour from the southeast, causing damage to marine and other interests in that section. A severe gale prevailed at Buffalo, N. Y., attaining a velocity of 48 miles per hour. Lake Erie was very rough, and the inner breakwater at Buffalo was submerged. 18th.—A heavy gale prevailed on Lake Michigan.

19th.—A heavy rain storm passed over New Haven, Conn., about 3.15 p. m. Lightning struck the tower of the Public Library Building, carrying off pieces of slating and doing other minor damage. Lightning also struck in two other places in the vicinity of the library building, and caused damage to telegraph and telephone wires. In the centre of the city basements and cellars were flooded and sewers overflowed. At New London, Conn., high wind prevailed in the morning, and a very high sea was running from east to southeast. Considerable damage was also reported in other Connecticut towns by lightning and rain. The storm was quite severe in south-east New York, and a number of wrecks were reported in Massachusetts Bay. 22d.—A severe storm swept over Gilmer, Fannin, Lumpkin, Pickens, and Dawson counties, Ga., causing considerable damage in the mountain forests. A heavy rain and wind storm occurred at Mount Alta, W. Va. Small mountain streams were swelled and carried away fences, damaged bridges, etc. 22-23d.—A northeast gale and heavy rain prevailed at Mossing Ford, Va. 23d.—A severe storm, with lightning and heavy rain, prevailed at Tampa, Fla., in the early morning. A lumber and saw mill was struck by lightning and burned; damage, \$30,000. Heavy northeasterly gales prevailed over Chesapeake Bay and along the middle Atlantic coast, causing considerable damage on land and sea,

and delaying vessels. 24th.—High seas and heavy gales caused great damage along the middle Atlantic coast. During a heavy storm with high northwest wind, a small vessel was blown ashore on Long Island Sound, a steam yacht was wrecked, and considerable damage was done along the Long Island coast and on the Sound. At Block Island, R. I., the wind reached a velocity of 78 miles per hour at 9.08 p. m. No vessels left the harbor; several broke from their moorings, and two sunk. At Boston, Mass., the wind reached a velocity of 48 miles per hour from the northeast, with heavy seas, and considerable damage was done to shipping, wharfage, and sea-side property in that section. 24–25th.—A northeast gale, with rain, commenced at Vineyard Haven, Mass., the night of the 24th and continued until 11 a. m., 25th, causing damage to hotel property, washing away bathing houses, and prostrating the telegraph line. The approach to the gauges and anemometer of the Signal Office was torn away. 26th.—A heavy wind and thunder-storm occurred at Cape Henry, Va., in the afternoon. At Cleveland, Ohio, high wind, with rain and small hail, prevailed. A loaded lumber barge was wrecked on the breakwater; one of the crew was drowned. 29th.—High wind, with rain and small hail, prevailed at Cleveland, Ohio, during the evening. A schooner went ashore inside the west breakwater.

#### WATER-SPOUTS.

Four water-spouts were observed 6 miles wnw. from Key West, Fla., between 5.20 and 5.45 p. m., 2d. One spout continued about 20 minutes. Another, somewhat larger, developed at 5.35 p. m., and, although it extended but half-way down, churned the water beneath it to a considerable height. Down the centre of these spouts a light or transparent core was observed. The other two spouts were in the first stages of formation, and were consequently very small. One ex-

tended from the base of the cloud towards the southwest at an angle of 45°, and the other curved towards the northeast at an angle of 35°. On the 19th, at 3.30 p. m., a water-spout formed during a storm near the new light-house, 5 miles from New Haven, Conn., and moved rapidly westward along Long Island Sound. It then moved eastward. A water-spout was seen later at Milford, about 10 miles distant. It was a huge black mass 200 to 400 feet in height and about 25 feet in diameter. As it moved westward it diminished in diameter. The gyration of the spout was very rapid, and the water in its vicinity was greatly agitated. Three water-spouts were observed moving from west to east two miles south of Hatteras, N. C., at 2.20 p. m. of the 26th. One extended from cloud to sea, and was complete, and the others were only partly formed and hung downward from the clouds.

#### Storms at Palmetto, Nev., August 7 and 11, 1890.

On the 11th two intensely black thunder clouds appeared over the crests of the surrounding mountains, one approaching from the north, and the other from the east. A short distance from Palmetto these clouds seemed to join, and rushed with extraordinary swiftness towards Palmetto. The resultant cloud was riven with lightning, and the air became filled with a terrific roar above which the thunder was hardly audible. A column of water poured down, excavating a trench about 500 feet long, and, in places, 7 feet deep and 20 feet in width. Within 10 minutes the entire lower part of the Palmetto Valley was 2 to 3 inches under water, and the cañon leading to Fish Lake Valley was a torrent. The stage road was obliterated for 9 miles, although the rainfall extended but little beyond Palmetto.

The storm of the 7th was very similar to that of the 11th, except that the rain seemed to come from one cloud, only. This cloud appeared to touch the ground and roll down the mountain side, and the rain covered a greater area.

### ATMOSPHERIC ELECTRICITY.

#### AUROSAS.

Auroras were reported as follows: 1st, Mount Saint Mary's, Md.; Wilkes Barre, Pa. 4th, New Haven, Mo. 5th, New Hartford and Southington, Conn.; Eastport and Orono, Me.; Cambridge, Fall River, and Newburyport, Mass.; Berlin Mills, Hanover, Manchester, and Nashua, N. H.; Madison, N. J.; Lowville and New Lisbon, N. Y.; Eagle's Mere, Pa.; Flaudreau and Wolsey, S. Dak.; Hartland, Vt. 8th, Tatoosh Island, Wash. 9th, Wolsey, S. Dak. 10th, Mount Saint Mary's, Md. 13th, Eastport, Kent's Hill, and Orono, Me. 14th, Glendive, Mont. 16th, Seymour, Ind. 17th, New Hartford, Conn.; Lacon, Lincoln, Louisville, Riley, and Rushville, Ill.; Angola and Seymour, Ind.; Afton, Alta, Amana, Bancroft, Cresco, and McCausland, Iowa; Barren Creek Springs, Md.; Amherst, Royalston, and Somerset, Mass.; Alpena, Detroit, Lausang, Manton, Marquette, Sault de Ste. Marie, and Thoruville, Mich.; Glendive, Mont.; Nashua, N. H.; Beverly, Egg Harbor City, Madison, Moorestown, and Rancocas, N. J.; Buffalo, Ithaca, Lowville, New Lisbon, and Oswego, N. Y.; Fort Buford, N. Dak.; Bangorville, Bement, Lordstown, and North Lewisburgh, Ohio; Erie, Coatesville, Grampian Hills, Eagle's Mere, Le Roy, and Nisbet, Pa.; Block Island, R. I.; Rapid City, S. Dak.; Embarrass, Wis. 18th, Grampian Hills, Pa.; Rapid City, S. Dak. 20th, Mount Saint Mary's, Md. 21st, Mount Saint Mary's, Md.; Milwaukee, Wis. 26th, Huron, S. Dak. 27th and 29th, Grinnell, Iowa. 30th, Mount Saint Mary's, Md.; Palestine, Tex. 31st, Grinnell, Iowa; Mount Saint Mary's, Md.

On the 17th auroras were observed from New England to the Dakotas and southward to Maryland and the Ohio Valley. The following are among the more notable displays reported: Manchester, N. H., 5th: a diffused auroral light resembling

the dawn of day was observed in the north from 7.30 to 9.30 p. m. Its color was a very light yellow tinged with crimson, and it rose to altitude 30° and extended from azimuth 145° to 220°.

Buffalo, N. Y., 17th: a faint auroral arch was observed from 8.20 to 8.50 p. m., being brightest about 8.40 p. m. The arch extended from 20° east of north to 15° west of north, and the elevation of the centre when the display was most brilliant was 25°. The arch broke in the centre at 8.43 p. m., and disappeared rapidly.

Sault de Ste. Marie, Mich., 17th: an aurora consisting of a well-defined arch of a light gray color, extending from 200° to 280° of azimuth and to 20° altitude was observed above a dark segment; a few streamers shot up to altitude 40°. The maximum brilliancy was about 2 a. m., 18th, and the display disappeared about 4 a. m., 18th.

Marquette, Mich., 17th: an aurora in the shape of a double arch of diffused white light was observed at 7.30 p. m. One arch extended from azimuth 130° to 225°, and the other from east to west-northwest, cutting the zenith. The display lasted until midnight.

Fort Buford, N. Dak., 17th: an aurora, consisting of a gray line, of irregular form, extending between northwest and northeast and to altitude about 20°, was observed at 8.55 p. m. Two streamers of a reddish tinge were observed, one near the centre, and the other near the eastern end of the display, which remained without material changes until 9.28 p. m. The aurora continued until 10.40 p. m., when it had entirely disappeared. The display was not clearly visible, as the northern horizon was partly obscured by clouds.

#### THUNDER-STORMS.

The more severe thunder-storms of the month are described under "Local storms." East of the Rocky Mountains thunder-